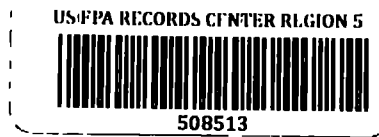


Memo

To: File



RE: Fridley Commons Park Well Field Technical Memorandum

Introduction

The Fridley Commons Park Well Field (Site) is an active well field with eight public wells (Well Nos. 2, 3, 4, 5, 6, 7, 8, and 9), owned by the city of Fridley (City), Minnesota. The well field serves a population of approximately 29,000. The Site is located within the city of Fridley (City), Anoka County, Minnesota, approximately one mile north-northwest of the intersection of Interstate Highway 694 and Minnesota State Highway 65. The Site is approximately one mile east of the Mississippi River and approximately 0.2 miles northwest of Moore Lake. (Figure 1) The Commons Park well field site provides recreational activities, and land use in the area surrounding the Site is mostly residential, with some areas of commercial and industrial use.

The City owns and operates eight municipal water supply wells and a water treatment plant (City Plant #2) at the Site. Four of the wells (6, 7, 8, and 9) are open to the Prairie du Chien-Jordan (PdCJ) aquifer and four of the wells (2, 3, 4, and 5) are open to the Mt. Simon-Hinckley aquifer. Water from all eight wells can be blended and treated at Plant #2.

On February 20, 1991, the Fridley Commons Park Well Field site (Site) was placed on the Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) inventory of potential hazardous waste sites, which is administered by the U.S. Environmental Protection Agency (EPA). The Site was assigned an EPA identification number, (ID No. MND985701309), so that CERCLIS-related activities could be tracked for the inventory.

History

Prior to 1958, the Site was mostly undeveloped tax-forfeited land, characterized by small sand dunes and prairie grasses. The City and the school district began acquiring the property in 1958.

The oldest well in the well field, city well No. 2, was drilled in 1960. Other wells were added to the well field in the 1960s and 1970s. At least two wells (No. 7 and No. 9) were deepened from the glacial drift aquifer to the PdCJ Aquifer in the early 1970s. Wells 6-9 provided 45 to 75 percent of the City's total water supply during this time.

In 1981, the City began sampling municipal wells for the presence of volatile organic compounds (VOCs). Trichloroethylene (TCE) was detected in well 9 in February 1984, although it was not detected in blended water from the well field. Subsequent testing of the wells at

the Site revealed that the four PdCJ Aquifer wells (No. 6 - No. 9) were contaminated with low levels of VOCs (mainly TCE).

Analyses indicated that well No. 9 consistently had the highest concentrations of TCE. Between 1989 and 1993, Well No. 9 often showed TCE levels above the Maximum Contaminant Level (MCL) of 5 micrograms per liter (ug/L), with concentrations as high as 79 ug/L (April, 1992) (Figure 2).

In 1989, EPA added TCE to the list of chemicals with Maximum Contaminant Levels (MCLs) under the Safe Drinking Water Act. The MCL is considered the maximum concentrations of contaminants allowed in public water supply systems. The MCL for TCE is 5 ug/l.

In November 1989, blended water from the well field was found to exceed the MCL for TCE. On February 20, 1991, the Fridley Commons Park Well Field site (Site) numbered MN985701309, was placed on the Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) inventory of potential hazardous waste sites. In 1992, well No. 9 was taken out of service because it showed the highest TCE levels. The MPCA added the Site to the State Permanent List of Priorities (PLP) in June 1992. The site was subsequently added to the National Priorities List (NPL, commonly referred to as "Superfund") in February 1999.

In 1989, the City hired Bruce A. Liesch Associates, Inc. (Liesch) as their consultant to investigate the TCE ground water contamination at the Site. Liesch installed three glacial drift aquifer monitoring wells at the Site (MW1, MW2 and MW3). Analytical data from these wells have indicated that the glacial drift aquifer in the vicinity of the Site does not appear to be impacted by TCE contamination. Liesch also conducted file searches at the MPCA to investigate potential off-site sources of TCE contamination, and initially identified approximately 100 potential source sites within six miles of the Site.

In addition to taking well No. 9 out of service, the City has attempted to use careful blending and decreased reliance on the PdCJ Aquifer wells in order to meet water quality standards at the well field. However, the City has indicated that periods of peak demand in the summer have forced them to utilize three of the contaminated wells (6, 7, and 8). This renewed pumping action caused the TCE levels in the wells to rise again. Thus, the available data show that TCE concentrations in the contaminated wells seemed to be directly related to the volume of water pumped from the wells.

Since October 1992, the City's water supply system has been partially supplemented by an interconnection to the New-Brighton water system. This interconnection provides excess water from a groundwater treatment system installed in New Brighton to remediate groundwater affected by the release of TCE from the Twin City Army Ammunition Plant (TCAAP). The interconnection provides most of the water the City uses in the winter, but as New Brighton's summer demand increases there is little water to be provided to Fridley.

Geologic and Hydrogeologic Setting

Geology at the site consists of unconsolidated Fridley Formation sands (10 - 30 ft. thick), Twin Cities Formation clayey till (50 - 80 ft. thick), and Hillside Sand (30 - 60 ft. thick), underlain by St. Peter Sandstone (20 - 35 ft. thick), the Prairie du Chien Group (110 - 130 ft. thick, consisting of fractured dolomite with interbedded sandy layers), Jordan Sandstone (95 ft. thick), and St. Lawrence Formation (20 - 30 ft. thick, a dolomitic shale which functions as a regional confining layer). The Prairie du Chien Group and the Jordan Sandstone are hydraulically connected and function as a single aquifer, referred to as the Prairie du Chien/Jordan aquifer. This aquifer functions as the primary groundwater source for drinking water in the Twin Cities area. Municipal wells 6, 7, 8, and 9, which have been impacted by TCE contamination, are open to the Prairie du Chien/Jordan aquifer (PdCJ).

Underlying these units are (in descending order) the Franconia Sandstone, Ironston Sandstone, Galesville Sandstone, Eau Claire Formation, Mt. Simon Sandstone, and Hinckley Sandstone. The Franconia, Ironston, and Galesville sandstones are hydraulically connected and produce low to moderate amounts of groundwater. The Eau Claire Formation, a regional confining unit consisting of silty-grained sandstone with interbedded shale, separates the Franconia, Ironston, and Galesville sandstones from the Mount Simon and Hinckley sandstones. Like the Prairie du Chien/Jordan aquifer, the Mount Simon and Hinckley sandstones also function as a single aquifer, commonly referred to as the Mt. Simon/Hinckley aquifer. Municipal wells 2, 3, 4, and 5 are open to the Mt. Simon/Hinckley aquifer.

Ground water for the surficial aquifer is found at a depth of 45 to 60 ft. below ground surface at the site. Ground water flow directions within the units described above is east-southeast, toward the Mississippi River that is located approximately one mile west of the site. Ground water in the Prairie du Chien Group, the primary aquifer in the area, is under confined conditions.

The unconsolidated (drift) units, along with the Prairie du Chien and the Jordan Sandstone are the primary geologic units that need to be considered with respect to detections of TCE in samples from municipal wells at the site. The shallow aquifer located within the unconsolidated units has not been found to be contaminated. Therefore the contamination found in the Prairie du Chien aquifer is likely attributed to a source that has migrated to the well field from outside the site area and not from the contaminated soils at or near the site.

Since the ground water contamination at the Site is limited to the PdCJ wells (Nos. 6, 7, 8, and 9), the hydrogeologic setting is defined by the conditions in the PdCJ Aquifer. The municipal wells which have been impacted by TCE contamination (i.e., Nos. 6, 7, 8, and 9) are open to the PdCJ Aquifer. However, as shown in Figure 3, these wells rely mainly on the Prairie du Chien as a source of water, since they intersect only a short section of the Jordan. Thus, the hydrogeologic characteristics of the Prairie du Chien Group are significant, while the hydrogeologic characteristics of the Jordan Sandstone are relatively insignificant with respect to these four wells. The fractured, sometimes karsted nature of the Prairie du Chien is

extremely important in this context, and probably plays a large role in controlling ground water movement through the aquifer.

Other important factors in the hydrogeologic setting at the Site include the effects of past erosion on the Prairie du Chien Group and the Jordan Sandstone. For example, there are several bedrock valleys in the vicinity of the Site, where the Prairie du Chien and the Jordan have been partially or completely removed by erosion. These buried bedrock valleys can permit fairly direct migration of ground water and contaminants into or out of the aquifer. In addition, the bedrock valleys can affect the confined/unconfined nature of the aquifer, as well as flow gradients and flow directions in the aquifer.

Since the PdCJ is such an important aquifer in the region, pumping effects of the nearby wells are significant with respect to the movement of contaminants through the aquifer. There are quite a few wells near the Site that are open to the PdCJ Aquifer. Some of these wells are high capacity industrial or municipal wells and may have large radii of influence so that they could produce well interference in the vicinity of the Site.

An important factor concerning the hydrogeologic setting is the type of contamination in the ground water. TCE is a commonly used industrial solvent which is slightly soluble in water and is denser than water. When pure TCE enters ground water from a source, some of it will dissolve in the ground water. The rest however continues to migrate downward through the aquifer(s) in the form of a dense non-aqueous phase liquid (DNAPL), due to gravity, until it hits a confining layer. These two phases of TCE have different physical properties and migration characteristics, although they are both subject to changes in the aquifer attributes (e.g., hydraulic conductivity). It should be noted that TCE in the form of a DNAPL has never been found at the site, and it is unlikely that a DNAPL source of TCE will be found at the site given the fact that dissolved concentrations of TCE are below those which are commonly associated with a nearby TCE DNAPL source.

Proximity to drinking water supplies

A limited well survey was conducted in the immediate area and identified wells have been sampled; however, the extent and direction of the TCE plume was not identified due to the complexity of the 200-300 feet deep fractured bedrock aquifer (PdCJ). Several other public water supply wells for other municipalities are located within a four-mile radius of the Site. In addition, several private and many industrial wells also are operated in the area.

Nature of release, Contaminant type, Affected media

In February 1984, trichloroethylene (TCE) was detected in City well No. 9. Subsequent testing detected TCE and several related break-down organic chemicals in wells Nos. 6, 7, 8, and 9. However, all chemicals except TCE have only sporadically been detected at very low levels and have not been found in recent sampling. Thus only TCE is considered a chemical of concern. The affected media (the Prairie du Chien aquifer) is used for drinking water supply by the City. The four city drinking water supply wells in the Mt. Simon-Hinckley (Nos. 2, 3, 4, and 5) have so far not been impacted.

Ground Water Supply Systems

The City operates a municipal water supply system that utilizes 13 wells, and supplies drinking water for approximately 29,000 people. All 13 wells are located within four miles of the Site; however, only five of these wells are open to the PdCJ Aquifer.

Other municipal water supply systems located within four miles of the Site include those operated by the cities of Blaine, Brooklyn Center, Brooklyn Park, Mounds View, New Brighton, St. Anthony, and Spring Lake Park. (The Blaine and Spring Lake Park municipal wells are not open to the PdCJ Aquifer, and only some of the other cities' wells draw water from the PdCJ Aquifer. Figure 4 shows the municipal PdCJ Aquifer wells located within four miles of the Site, and also lists the populations apportioned to each well. Some private wells also utilize the PdCJ Aquifer, and these are listed in Figure 5, along with wells listed in the County Well Index within a Two-Mile Radius of the Site.

Past Response Actions

As required by the Minnesota Department of Health (MDH), the city of Fridley took well No. 9 out of service due to contamination levels which might cause the water supply to exceed the MCL. Wells 6, 7, and 8, while at various times exhibiting contamination from TCE, remain in service and are used primarily during times of peak summer water usage. The City has continued to monitor the affected wells as required by MDH.

On February 20, 1991, the Fridley Commons Park Well Field site (Site) numbered MN985701309, was placed on the Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) inventory of potential hazardous waste sites. The Preliminary Assessment (PA) was completed by Minnesota Pollution Control Agency (MPCA) staff and was approved by the EPA on September 20, 1991. A Screening Site Inspection (SSI) was conducted by MPCA staff on November 5 and 6, 1991. The SSI report was submitted to EPA and approved on July 6, 1992. The SSI recommended the Site for an Expanded Site Inspection (ESI). The Site was added to the State of Minnesota's Permanent List of Priorities, or State Superfund List, in June 1992. The 1996 ESI recommended listing on the NPL and more effort to define the source within the limitations of cost. The site was listed on the NPL in February 1999.

The MPCA has conducted investigations since the closure of well No. 9 to narrow the range of the contamination source possibilities. In 1997 the MPCA contracted with Barr Engineering Company (Barr) to perform a file evaluation of the Site. Their report, Evaluation of Ground Water Contamination, Fridley Commons Park Well Field Site, March 1997, recommended an alternative water supply to be planned for implementation during peaking periods, some longer-term investigative techniques, and additional work to locate the source. The Barr report also summarized existing data from previous reports and the files. The report concluded that it is likely an MCL violation would occur in the future. Therefore, it was recommended that a more reliable source of TCE-free water should be found.

The Barr report also listed some recommendations for additional work to locate a source of TCE including: Resample monitoring wells MPCA well MW2 and the Stylemark well; investigate the Moore Lake dump site; and continue to track VOC data at new groundwater sites within a two mile radius. If additional monitoring wells were to be installed, use of a multi-layered groundwater model should be considered.

In 2000 the MPCA contracted with Delta Environmental Consultants to conduct a Limited Remedial Investigation of the site. MPCA MW2 was sampled for TCE, along with other existing monitoring wells in the area, and the Moore Lake Dump was investigated. To do this a new monitoring well (MW4) was placed near the area of the dump. However, homes were present over the dump area, and further investigation was therefore limited. TCE was not detected in the groundwater monitoring from this new well MW4 (Figure 6 Evaluation of more recent data for wells 6-9 showed reduced levels of contamination with only well 9 consistently over the MCL (as of year 2000).

In 2002 the MPCA contracted with Delta Environmental Consultants to prepare a Focused Feasibility Study (FFS). The FFS study looked at several alternatives before choosing the installation of carbon filters. Price was estimated at \$2.4-3.2 million initial capital costs.

In January 2004 MPCA staff requested (from the City) copies of the recent VOC analysis from wells 6-9. At that time, staff were informed that the wells had all tested below the MCL for TCE of 5 ug/l. When wells are in use they are sampled once a month for VOCs. These results are included in Figure 7.

According to the City, wells 6-9 were used throughout the summer of 2004. Whereas studies in the 1990's showed levels of contamination increasing with usage, recent trends do not show that condition. The city and MDH will continue to monitor the wells while they are being used. Additionally DCE or vinyl chloride (the breakdown products of TCE) have not been detected.

Well 13

A November 17, 2000 Health Risk Assessment Report written by the Minnesota Department of Health included City Well 13 as an area of concern for the Fridley Commons Park Well Field. This well is approximately 1 mile SW of the Commons Park area and is contaminated with TCE levels that exceed the MCL. The well is located near the Mississippi River in the Prairie du Chien/Jordan aquifer. The well is set up to pump groundwater directly into the water supply system without treatment.

The MPCA expressed concern during the comment period that this well, while important, is outside of the area defined as the Commons Park well field site. However the MDH left the well in the report as a concern.

The MPCA is still of the opinion that this well should be considered a separate problem. First, the well is closer to other Superfund sites that also have TCE as the primary concern. The well is just north of the NIROP Superfund Site and slightly northwest of the Dealers and Kurt Manufacturing superfund site. Wells at these sites exhibit higher

levels of TCE than have been found at the Commons Park Well Field site, and are closer to Well 13, and could impact Well 13.

While wells 6-9 are contaminated with TCE, other VOC compounds are not routinely found. Well 13 has TCE contamination and also shows other VOC contamination as well. Specifically chloroform, carbon tetrachloride and cis-1,2,-Dichloroethylene have also been found in Well 13.

Lastly, the MPCA, when it listed the Fridley Commons Park Well Field site, did not consider Well 13 to be part of the defined site. MPCA staff conversations confirmed this.

According to City personnel, Well 13 has not been used in several years. A recommendation to not use that well, along with the increased water pumping capacity the city has available when they can use wells 6-9, should provide sufficient water to the system so that Well 13 is no longer needed.

Summary:

TCE was the only contaminant found consistently at levels of concern. A limited investigation was conducted in an attempt to identify the source of the contamination in the Fridley Commons Park Well Field. There was no source that could be clearly identified or attributed to the contamination at the site. Monitoring wells placed in the unconsolidated glacial drift water table aquifer indicated that the shallow aquifer is not contaminated. Therefore, it appears that the source of the TCE is not from the site area itself but has migrated to the well field from some other location.

As a fractured bedrock system, the Prairie du Chien aquifer flow characteristics are highly variable. At the well field, the depth of the Prairie du Chien aquifer ranges between 120 and 250 feet below ground surface (roughly 820 ft. MSL). Together, the depth and the fractured flow nature of the aquifer makes any investigations very costly, with limited benefits.

Elevated levels of TCE were present in wells 6, 7, 8, and especially 9 in the 1980's and early 1990's, but the levels of TCE have subsequently decreased. During 2004 the City pumping rates for Wells 6-9 were the highest they have been since the early 1990s. This increased pumpage has not resulted in increased TCE levels. Provided the levels of TCE remain below MCLs, the City will be allowed by MDH to use the wells.

In assessing the need to further characterize the site, the following information was considered:

- 1). Only one medium has been impacted (i.e. groundwater);
- 2). Concentrations of contaminants at the site are below screening levels (the first step in a traditional risk assessment)
- 3). Concentrations of TCE are and have been below a regulatory health-based standard (i.e. MCL) in all four Prairie du Chien aquifer wells. Wells 6, 7, and 8 have been below the MCL since November 2001. Well No. 9 has been below the MCL since January 2004;

4). According to the NCP for contaminants with MCLGs of zero, MCLs are considered protective unless extenuating circumstances exist (e.g. multiple contaminants or multiple pathways), none of which are present at this site;

5). Future risks would be even lower since the concentrations are expected to continue to decline; and

6). Additional investigations to identify the source of contaminants will likely be costly with a low likelihood for success.

Since current concentrations of TCE in the ground water do not present an unacceptable risk to human health or the environment, additional investigations to identify the source of the contamination was determined not to be necessary at this time. The uncertainties related to the source and flow characteristics of the aquifer can be reasonably managed through future ground water monitoring. If monitoring results indicate that TCE concentrations are increasing or have exceeded the MCL, additional investigations can be conducted at the appropriate time.